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Forest Service

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Jack Pine

An American Wood

ORIGINAL

More than 99 percent of the jack pine growing in the United States is located in the Lake States, where it is one of the most important pulpwood species. Jack pine grows farther north into Canada than any other pine. It belongs to the hard pine group and is included as one of the important northeastern pines along with red pine and pitch pine. It can grow on dry sandy soils but grows best on well-drained loamy sands. The wood is moderately light and soft, moderately low in bending strength, and low in shock resistance. It is used primarily for pulpwood in the sulphate process, but it is also used for building construction, boxes, crates, shipping containers, posts, poles, piling, mine timbers, railway ties, and fuel.

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Jack Pine
(Pinus banksiana Lamb.)

Thomas D. Rudolph[1]

Distribution

Jack pine grows in the northern forests of the United States and Canada (fig. 1). It grows farther into Canada than any other pine, with its northernmost extension reaching the Mackenzie River in the Northwest Territories. From there its northern limits extend eastward through Saskatchewan and Manitoba, Ontario and central Quebec, to Cape Breton Island, Nova Scotia. The southern edge of the range extends from Maine through central Michigan, northwest Indiana, and Wisconsin to Minnesota, then northwest through southern Manitoba, south-central Saskatchewan, and central Alberta to the extreme northeast of British Columbia. Isolated stands occur in southern Ontario, northern New York, and New Hampshire. The southernmost natural occurrence of jack pine is on the south shore of Lake Michigan in northern Indiana. About 70 percent of its natural range can be considered a commercial range. In Canada it is most abundant in Ontario, and in the United States most of the jack pine grows in the Lake States, where it occupies more than 2 million acres. The range has been artificially extended by planting on strip-mined areas in the Central and Northeastern States and on the sand hills of Nebraska.

Except in the eastern part of its range where it grows in a maritime climate, jack pine generally grows in diverse continental climates characterized by short, warm to cool summers, very cold winters, and moderate to low rainfall. Average July temperatures range from 55 to 72 °F and those in January range from -20 to 25 °F. Over the range of jack pine, average annual precipitation varies from 15 to 30 in-

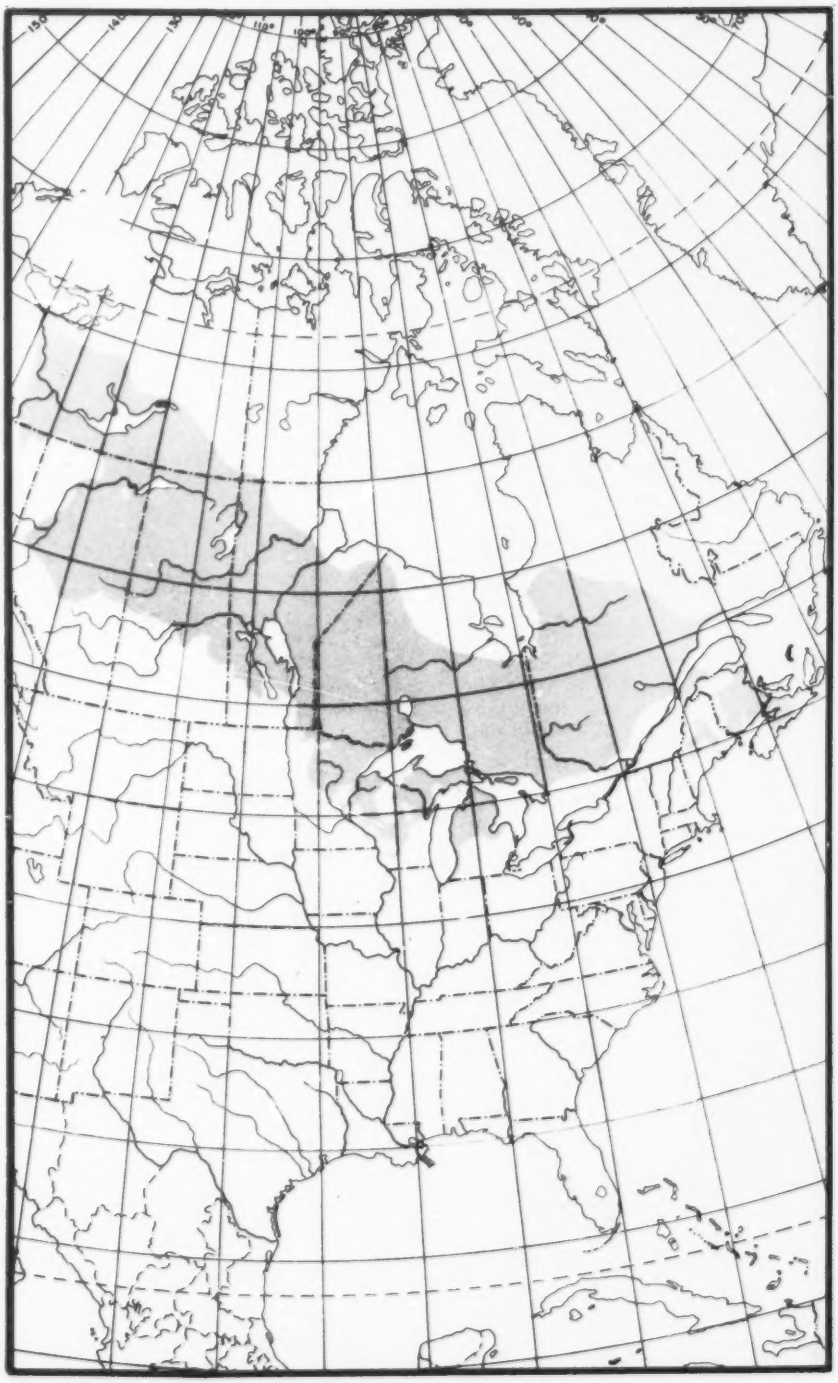

Figure 1—The natural range of jack pine.

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ches. Generally, average annual temperature, rainfall, and frost-free period increase from the northwestern toward the southeastern part of the range.

Jack pine can grow on very dry sandy or gravelly soils where other species can scarcely survive, but it grows best on well-drained loamy sands where the midsummer water table is within 4 to 6 feet of the surface. It also occurs on loamy soils, thin soils over granite, peats, and raw humus. The most extensive stands are found on level to gently rolling sand plains, and other land forms often of glacial origin. In the Lake States, jack pine grows at elevations between 1,000 and 1,700 feet above sea level but in the East it grows from sea level on the Atlantic Coast to 2,500 feet in New Hampshire.

Jack pine trees typically generate after forest fire and occur in pure, even-aged stands. Approximately three-fourths of the growing stock volume of jack pine is found in the jack pine forest cover type. Jack pine is a component of five other forest cover types: black spruce *(Picea mariana)*, paper birch *(Betula papyrifera)* aspen *(Populus tremuloides)*, red pine *(Pinus resinosa)*, and northern pin oak *(Quercus ellipsoidalis)*. Infrequent associated species include bur oak *(Quercus macrocarpa)*, northern red oak *(Quercus rubra)*, eastern white pine *(Pinus strobus)*, red maple *(Acer rubrum)*, balsam fir *(Abies balsamea)*, white spruce *(Picea glauca)*, tamarack *(Larix laricina)*, balsam poplar *(Populus balsamifera)*, white oak *(Quercus alba)*, pin cherry *(Prunus pensylvanica)*, gray birch *(Betula populifolia)*, red spruce *(Picea rubens)*, and pitch pine *(Pinus rigida)*. Jack pine is less shade tolerant than any of its principal associates except aspen and paper birch. Therefore, unless natural succession is interrupted by a major disturbance such as fire, jack pine is usually a temporary type that, at least on the better sites, is replaced by the more tolerant species.

Figure 2—Needles and cones of jack pine.

Description and Growth

In well-stocked stands, jack pine develops into a short to medium-tall, rather slender tree with a narrow, open crown covering 35 to 45 percent of the stem. Open-growing jack pine develops a stocky, poorly formed stem and a wide, spreading crown with persistent branches, often to the ground. During the first 20 years, jack pine in its native range grows faster than all other conifers except tamarack. On good sites in the Lake States, 20-year-old trees will average up to 32 feet tall and 4 inches in diameter at breast height (4½ feet). Mature trees are generally 55 to 65 feet tall and 8 to 10 inches in diameter, but exceptional trees 100 feet tall and 25 inches in diameter have been noted. In the Lake States, average merchantable yield at age 60 in unmanaged, well-stocked stands ranges from about 1,300 cubic feet per acre on poor sites to about 2,900 cubic feet per acre on good sites. In plantations on good sites, volumes in this range can be attained in 20 years by using seed of the best adapted origin.

Jack pine frequently develops a taproot as a seedling and maintains it to maturity. On deep, well-drained soils the roots may penetrate as deep as 9

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Figure 3—Scaly ridged bark of jack pine.

feet. Trees without distinct taproots usually have lateral roots that turn and grow downward as they approach other trees. The bulk of the root system consists of laterals confined largely to the upper 18 inches of soil and mostly in the top 6 inches. Roots spread laterally to at least 28 feet.

The needles of jack pine grow in pairs and are ¾ to 1½ inches long (longer on young seedlings), light green, flat or slightly concave on the inner surface, divergent, stout, often twisted, and remain on the tree for 2 or 3 years (fig. 2). The bark is brown and slightly tinged with red or dark gray. It is thin and irregularly divided into scaly ridges (fig. 3).

Mature cones may be produced on a small percentage of 2-year-old seedlings grown in the greenhouse and nursery. Jack pine in the field begins to produce significant cone crops at 6 years, and cone production continues regularly even on 185-year-old trees.

Jack pine cones are usually 1-1/2 to 2 inches long but occasionally may be less than 1 inch or more than 3 inches long. Cone form varies but most often is oblong and conical. The cones usually point toward the tip of the branch and are often strongly incurved with well-developed scales only on the outer face. Seed yield from the inside curvature of the cone is only about half that from the outside curvature. Seed yield per cone ranges from 15 to 75. Mature cones are light brown but turn gray with age. Seeds are one-twelfth of an inch long, triangular, usually black or dark brown (occasionally straw-colored), roughened, and bear wings about one-third of an inch long. Commercial jack pine seed ranges from 71,000 to 250,000 per pound. Under forest conditions with adequate moisture, seeds germinate when air temperatures reach 64 °F. The seed has little or no dormancy.

Jack pine has predominantly serotinous or closed and persistent cones over much of its natural range, so viable seeds may be retained on the trees for many years. These seeds are not released until the cones are opened by heat at a minimum temperature of 122 °F, because of fire or when cone-bearing slash is near the ground. This accumulation of seed in closed cones accounts for the dense jack pine regeneration that often follows the destruction of a parent stand by fire. However, in the southern parts of the range, cones on some trees open soon after they mature and seed may be released during any season.

Germination and early seedling survival are best on exposed mineral soil in partial shade. Once established, seedlings grow best in full sunlight. Summer droughts and high surface soil temperatures frequently kill or injure young jack pine seedlings. Jack pine is subject to numerous agents that can cause damage or mortality at various stages of reproduction and growth. Cone and seed insects can drastically reduce seed crops. Red squirrels and other rodents eat jack pine seeds. Survival and growth can be affected by various insects including root borers, shoot and stem borers, leaf feeders, and sucking insects. Numerous diseases

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attack jack pine including several rust fungi, root rots, and wood decay organisms. Surface wildfires kill seedlings and saplings, and hot fires can kill pole-size stands. Jack pine is somewhat resistant to windthrow but is susceptible to wind breakage especially in conjunction with glaze or ice storms.

Because jack pine is intolerant of shade, even-aged management using the clear-cutting, shelterwood, or seed-tree harvesting system is the only practical method to maintain the type. The clear-cutting system is used most often for harvesting jack pine stands, particularly those with trees bearing closed cones. The stand can then be regenerated by scattering closed cones from high-quality trees, direct seeding, or planting seedlings of adapted seed origin. Whichever regeneration method is used, some additional site preparation (sometimes including prescribed burning) is usually necessary to reduce slash, expose mineral soil seedbeds, and control competing vegetation.

Common Names

Jack pine is less commonly called gray pine, scrub pine, black pine, Banksian pine, princess pine, and Hudson Bay pine.

Supply

Forest inventory figures, compiled for various regions at different times between 1968 and 1980, indicate that the volume of jack pine growing stock in the United States is 1.65 billion cubic feet. More than 99 percent of this volume is in the Lake States: about 38 percent of the volume is in Michigan, 36 percent in Minnesota, and 25 percent in Wisconsin. The remaining 1 percent, only about 6 million cubic feet, grows in Maine and New York. The current growing stock volume is an increase from the 1.5 billion cubic feet reported in 1963. Approximately three-quarters of the present volume is found in the jack pine forest type, and the remainder is in other forest types of which jack pine is a component. As of 1977, net volume of jack pine sawtimber in the Lake States was 2.86 billion board feet: 55 percent in Minnesota, 28 percent in Wisconsin, and 17 percent in Michigan.

Production

In 1975, 42 million board feet of jack pine saw logs were harvested in the Lake States. This is about triple the 14.5 million board feet harvested in 1965. Of the 1975 saw log harvest, 29 million board feet or about two-thirds was in Minnesota, 8 million was in Michigan, and 5 million was in Wisconsin. The large increase in saw log production probably reflects the developing market acceptance of jack pine lumber in the building construction industry.

Jack pine accounted for more than 11 percent of the industrial roundwood production in the Lake States in 1975 and was the major softwood followed by balsam fir and spruce. In the Lake States, jack pine is second only to aspen in volume of pulpwood harvested.

During 1974-80 the average annual production of pulpwood harvested in the Lake States was 552,000 cords, which is about a 7 percent decrease from the average annual production of 591,000 cords for 1960–69. Since 1976, more jack pine pulpwood has been produced in both Michigan and Wisconsin than in Minnesota. Pulpwood harvesting in the Lake States during the 1974-80 period was at an annual rate of about 3 percent of the jack pine growing stock volume.

Characteristics and Properties

The sapwood of jack pine is nearly white and makes up to one-half the volume of a tree. The heartwood is yellowish to russet brown or occasionally reddish brown. Jack pine wood has the characteristic resinous odor of all pines and the taste is not distinctive. It is somewhat oily and feels slightly greasy. The grain is frequently spiral. Growth rings are distinct and are delineated by a pronounced band of darker latewood. The wood has a coarse texture and is somewhat resinous. The weight is moderately light with a density of 30 pounds per cubic foot at 12 percent moisture content, and a specific gravity of 0.40 based on green volume and ovendry weight. It is moderately low in bending and compressive strength, moderately low in shock resistance, and low in stiffness. Jack pine wood has moderately small shrinkage, and ranks average in workability with tools. It is more apt to split when nailed and has lower nail-holding capacity than red pine. Its durability is very limited when exposed to conditions favorable to decay, and penetration with preservatives is difficult. It does not hold paint well. Jack pine lumber is generally knotty and is prone to warp and check in drying.

Principal Uses

Jack pine is used primarily for pulpwood. It is mostly pulped by the sulfate method, because pitch is a problem with the sulfite and groundwood methods. The sulfate process yields a very strong pulp useful for manufacture of kraft paper, high-grade printing paper, fiberboard, and hardboard. Jack pine pulp can be mixed with groundwood and other pulps to produce a wide range of other products.

Another major use of jack pine lumber is for boxes, crates, and shipping containers, particularly by the heavy manufacturing and appliance industries. In the last 15 years, jack pine has been increasingly accepted and used as 2 by 4 stud lumber. The lumber is often mixed with the lower grades of white pine and red pine for distribution. However, better grades of jack pine lumber are marketed as red pine and sold

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for sash, doors, and interior finishes.

Additional uses of jack pine are for poles, posts, pilings, mine timbers, railway ties, slack cooperage, and fuel.

Many wildlife species, including major game species such as the snowshoe hare and white-tailed deer, find food and shelter in jack pine forests. The most notable special wildlife use of jack pine is as a breeding area for the Kirtland's warbler (*Kendrocia kirtlandii*), a rare and endangered species. Clumpy stands of jack pine between 5 and 20 feet tall and 7 to 20 years old in the Lower Peninsula of Michigan are being managed specifically for this bird. Jack pine has also been used in protective plantings for dune and sandblow control; for windbreaks; and on strip-mine areas, mine tailings, and pond levees.

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